BONNEVILLE POWER ADMINISTRATION CHEHALIS SUBSTATION
UNTANKING TOWER
State Route 603
Napavine vicinity
Lewis County
Washington

HAER No. WA-69-A

HAER
WASH
21-NAPAV.V
1A-

PHOTOGRAHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
Western Regional Office
National Park Service
U.S. Department of the Interior
San Francisco, California 94107

HISTORIC AMERICAN ENGINEERING RECORD

HAER
WASH
21-NAPAV.V
1A -

Bonneville Power Administration Chehalis Substation, Untanking Tower

HAER No. WA-69-A

Location: State Highway 603, ca. 3 miles west of intersection of State Highway 603 and Interstate 5 (I-5), ca. 1.75 miles northwest of Napavine, Lewis County, Washington

UTM: 10.504250.5160400
Quad: Centralia, Washington

Date of Construction: Completed 1941

Architect: Bonneville Power Administration

Contractor: O. R. Weyman
Portland, OR

Present Owner: Bonneville Power Administration

Present Use: Maintenance, repair, storage

Significance: The Bonneville Power Administration (BPA) Chehalis Substation untanking tower is an industrial building designed for specialized functions relating to substation maintenance within the BPA's Master Grid system. Completion of the Master Grid initiated the marketing and transmission of electrical power from Bonneville and Grand Coulee dams on the Columbia River, the first Federal hydroelectric facilities on that river. Construction of those dams and completion of the BPA's Master Grid network (1939-1945) represented Federal economic recovery programs instituted by President Franklin D. Roosevelt. Those programs played a prominent role in defense-related industries during World War II (1941-1945) and initiated the widespread and diversified use of electricity at nominal costs in the Northwest Pacific Coast states of Washington and Oregon. The original Master Grid has since been expanded to include eight states in the western region of the United States in the western region of the United States. The poured concrete untanking tower is an outstanding example of the Starved Classical style of industrial architecture commonly used in construction of BPA substation structures during the decade of the 1940s. The historic structure was determined eligible for inclusion in the National Register of Historic Places in 1987.

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Cheney, Washington
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INTRODUCTION

The Bonneville Power Administration (BPA) Chehalis Substation untanking tower is located in rural Lewis County in southwestern Washington State. It is located along State Highway 603 (SH-603), ca. 3 miles west of the intersection of SH-603 and Interstate 5 (I-5), near the village of Napavine, and ca. 8 miles southwest of Chehalis, the county seat of Lewis County. The Chehalis Substation is one of the original substations included in the BPA's regional power grid, a system created to market the integrated hydroelectric power of Bonneville and Grand Coulee dams.[1]

Those hydroelectric facilities were the first federally constructed dams on the Columbia River. Their completion, together with the construction of the BPA Master Grid network, played a prominent role in defense-related industries during World War II (1941-1945), and represented New Deal economic recovery programs instituted by President Franklin Delano Roosevelt to provide electric power at nominal costs for widespread domestic and industrial use in the states of Washington and Oregon.[2] The Chehalis Substation served as a vital connecting link in the 230 kv transmission line connecting Puget Sound in Washington State with the Vancouver, Washington, and Portland, Oregon, metropolitan areas.[3] Completed in 1941, the BPA's 114 x 84-foot poured concrete untanking tower served multiple functions, including repair of heavy substation equipment, maintenance of fleet vehicles, untanking of transformers, and parts and equipment storage.[4] The Chehalis Substation is owned, operated, and administered by the BPA.

In 1986, the BPA requested that personnel from Archaeological and Historical Services (AHS), Eastern Washington University, identify, evaluate, and nominate to the National Register of Historic Places (NRHP) significant buildings and structures that were part of the BPA's Master Grid. Properties at the Chehalis Substation, which were determined eligible for the NRHP for their architectural styling, exterior integrity, and functional significance within the Master Grid system, include the poured concrete control house and untanking tower. Those structures were erected in the Starved Classical style of industrial architecture representative of BPA structures during the decade of the 1940s.

MITIGATION FOR PROPOSED ALTERATIONS TO THE BONNEVILLE POWER ADMINISTRATION CHEHALIS SUBSTATION UNTANKING TOWER

The BPA proposes to install a 16 x 14-foot metal roll-up utility door on the northwest facade of the electrician's maintenance room, designated "Shop No. 8" in the original plans (see HAER Photographs No. WA-69-A-12 and WA-69-A-13). Installation of the new roll-up door will entail removal of two original multi-paned, metal-framed windows from a bank of five identical windows, elimination of the original metal-cased pedestrian double entryway doors, and removal of a portion of the original poured concrete structural fabrication. The Washington State Historic Preservation Officer (SHPO) has determined that these modifications will create an adverse effect to the physical integrity of the historic property. This report has been prepared in compliance with a Memorandum of Agreement among the BPA, the Washington SHPO, and the Advisory Council on Historic Preservation to mitigate the adverse effect of the BPA's undertaking on the historic property.

SITE DESCRIPTION AND LAYOUT

The Chehalis Substation is located in rural Lewis County, Washington. Characterized by gently rolling hills, the area is comprised of mostly small-scale farm and livestock operations. Cultivated fields, typically divided from animal pasturages and adjacent farm lands by natural deciduous and evergreen borders, enhance the pastoral character of the landscape. Situated within a park-like setting, the Starved Classical styling of the BPA Chehalis untanking tower and control house complements the serenity of the surrounding countryside.

The Chehalis substation is located on the right-of-way of the BPA's 230,000 volt main grid line connecting Puget Sound to the north with the Vancouver-Portland metropolitan area and the hub of the BPA grid system at the Ross Substation in Vancouver to the south. The Bonneville Power Administration Chehalis Substation untanking tower is part of the Chehalis Substation. The immaculate substation grounds are formally landscaped. Concrete curbing encloses mowed lawns, which are bordered by evergreen and flowering shrubbery and mature deciduous and evergreen trees. The substation is located adjacent to (southwest of) State Highway 603. The substation complex is oriented southwesterly along the highway, with the untanking tower set back from, but facing, the highway to the northeast (see HAER Photograph No. WA-69-A-1). The control house faces the untanking tower to the southwest. The two structures stand approximately 200 feet apart, and are separated by an asphalt-surfaced driveway and vehicle parking area. The outdoor switching yard, which is enclosed by a six-foot-high, chain-link security fence, parallels the untanking tower and the control house to the south and to the west. A modern steel-framed, metal vehicle parking garage is located adjacent to the southwest corner of the untanking tower's secondary facade (see HAER Photograph No. WA-69-A-2).

DESCRIPTION OF STRUCTURE

The Bonneville Power Administration Chehalis Substation untanking tower is a poured concrete rear-facing, T-shaped structure. Two flat-roofed wings, which stand 23 feet high and measure ca. 45 x 35 feet, extend from either side of the assembling room tower. The structure's northwest wing contains three ground floor rooms: "Shop No. 8" and "Tool Room 9" on the main floor, with "Oil Room 10" comprising the only basement room in the structure. "Store Room 5" occupies the structure's southeast wing (HAER Photograph No. WA-69-A-12 shows the nomenclature of the untanking tower's rooms as specified in the original floor plans).

A distinctive front entrance, accessed by three low-riser concrete steps, leads to the structure's office. The flat-roofed facade entrance repeats the horizontal lines and spare geometric shapes that are representative of the structure as a whole. The entryway's dropped roof line and the flat concrete canopy that caps the structure's original metal-cased, multi-paned doorway and entrance windows add visual interest to the structure. Two multi-paned portal windows, one on either side of the main facade entrance, soften the structure's spare linear planes. Design details of the untanking tower's distinctive architectural styling are illustrated in HAER Photographs No. WA-69-A-12, WA-69-A-13, and WA-69-A-14, which show the 1941 drawings of the structure's first floor plan, right side elevation, and front elevation, respectively.

The structure is dominated by a massive tower (designated "Assembling Room 6" in the original plans) that rises from the central mass of the building (see HAER Photograph No. WA-69-A-12). Roughly as tall as a four-story building (the structure stands 63 feet high at the top of the tower), the assembling room's imposing height is emphasized by three soaring vertical, multi-pane, metal-cased windows on its primary and rear facades. Small square, multi-pane, metal-cased windows are situated above the vertical windows, creating a mock transom effect. Five identical windows, located on the same level and identical to those on the assembling room's (tower's) primary and rear facades, form the fenestration on the tower's east and west facades. A series of awning-style windows provide both light and ventilation to the assembling room's lofty interior. Because of the imposing height and expanse of the window openings, each level of window openings is fitted with a rod, which extends the length of the bank of window openings, and is connected to a crank on a gear transfer box on the opposite side. The electrically-powered system pushes and pulls the windows open and closed as needed.[5]

Exterior access to the assembling room, a space originally designed principally for transformer maintenance, is located in that room's northwest corner. "3-Leaf" steel and glass sliding doors, mounted on an overhead steel track, provide the opening for the 7-foot-wide rail tracks that lead into the assembling room from the transformer pads in the substation switching yard (see HAER Photograph No. WA-69-A-12). In appearance, the doorway replicates the window treatment on the assembling room's primary facade, creating the appearance of a window-wall (see HAER Photograph No. WA-69-A-9).

ALTERATIONS AND ADDITIONS

The only significant alteration to the Bonneville Power Administration Substation untanking tower entailed the recent replacement of the original 3-Leaf sliding doorway on the southeast assembling room wall with a metal roll-up utility doorway (see HAER Photograph No. WA-69-A-8). There have been no other apparent exterior alterations to the structure, although a modern single-story, metal-clad vehicle storage shed has been erected adjacent to the southwest corner of the untanking tower. However, the vehicle garage, which is located on the structure's secondary facade, does not create an unsightly intrusion to the setting of the industrial complex.

STRUCTURE'S PRESENT CONDITION

The Bonneville Power Administration Chehalis Substation untanking tower appears essentially unaltered from its original condition (see HAER Photograph No. WA-69-A-10 for the main facade view of the structure as is appeared at the time of its completion in 1941 and HAER Photograph No. WA-69-A-1 of the same view of the structure as it looked in 1992). The structure has been well-maintained, as have the grounds of which it is a part. Although some usages of the structure have been modified since the time of its construction; most notably, transformers are no longer conveyed into the assembling room for maintenance, other functions for which the building was originally designed have remained essentially unchanged. The historic and present functions of the Bonneville Power Administration Chehalis Substation untanking tower are described in the following **ENGINEERING SIGNIFICANCE OF THE STRUCTURE** section of this report.

ENGINEERING SIGNIFICANCE OF THE STRUCTURE

The Bonneville Power Administration Chehalis Substation untanking tower is an industrial structure built by the BPA to facilitate the maintenance and repair of mechanisms related to the operation of electrical generating equipment and to other apparatus associated with electrical transmission from that important BPA substation. The building was designed expressly to accommodate specialized equipment pertaining to those operations. Central to design considerations was the need for a space large enough to contain the original 150 ton-each transformers that were installed at the Chehalis Substation. The four transformers received 230 kv power from the main line BPA transmission grid and reduced the voltage for use by local customers. Transformers serving 230 kv voltage transmission lines typically measured over 15 feet in height. Thus, the BPA needed to design a structure large enough to allow for the performance of potentially extensive repair and maintenance work to those mechanisms in a safe and controlled environment.

In theory, construction of the Bonneville Power Administration Chehalis Substation untanking tower, and others like it that were built as part of the BPA Master Grid electrical transmission network, allowed for on-site maintenance of substation transformers. Those service structures eliminated the need for transporting the huge transformers over long distances for maintenance and repair. They also reduced dependence on expensive replacement parts by allowing for on-the-premisses parts fabrication and repair.[6]

Untanking the giant transformers required the coordination of both men and equipment. "Rigging crews" first moved the transformer from sliding rails, which extended from the transformer pads in the switching yard into the assembling (untanking room), onto a small, low flat car.[7] A motor vehicle then towed the transformer along the track to a service area behind the untanking tower. There, crews drained the oil from the transformer before conveying the mechanism into the assembling room. The transformer was completely "dried out;" that is, the oil it contained was drained and cleaned of contaminants before the transformer was moved into the assembling room.[8] "Untanking" the transformer referred to removal of the metal sheath or "tank" that covered the transformer's electrical components. From a crow's nest located near the ceiling of the four-story assembling room tower, a crane operator maneuvered the 125-ton Judson Pacific "Murphy" crane (see HAER Photograph No. WA-69-A-8) into place over the equipment and lowered electrically-powered hooks to pick points on the transformer's tank. The crane lifted the protective metal covering (the tank) from the transformer's core (a series of wire coils). Electricians and other skilled workmen then performed maintenance and repair work on the mechanism as needed.[9]

Because of the presence of highly combustible materials, and the proximity of high-voltage electricity during untanking, maintenance, and repair work on the transformers, BPA architects incorporated safety features into the untanking tower's design. Most notably, a fire wall door was constructed between the tool room and the assembling room to protect the basement oil room and other highly flammable areas from exposure in the event of fire. If a fire occurred, the fire door featured a slanted sliding rack with fusible links that melted at high temperatures. Gravity then activated a system of pulleys and weights designed to slide the door shut, where it was sealed.[10]

Another important function that occurred in the Bonneville Power Administration Chehalis Substation untanking tower was (and is) the draining, cleansing, and recirculation of oil in the switching yard oil circuit breakers (OCBs), transformers, and associated apparatus. Oil passes from substation equipment into six oil storage tanks located at the rear exterior of the untanking tower, directly behind the assembling (untanking) room (see HAER Photographs No. WA-69-A-3 and WA-69-A-4). Originally, oil passed from the storage tanks through underground piping (which has since been replaced by above-ground hoses) into a manifold system in the oil press room. The manifold system takes oil (both dirty and clean) from the transformers and OCBs, where the oil is either directed to the oil press for cleaning or redirected to the switching yard mechanisms following decontamination in the oil press. The oil used in substation transformers and OCBs is not a lubricating oil, but an electrical insulating fluid designed specifically for the electrical power industry. That product, which has an extremely high flash point, breaks electrical power by absorbing heat from the arc and quenching it. The exterior oil storage tanks, manifold system, and oil press are designed to recirculate the oil so that the product essentially lasts indefinitely.[11]

The oil press is an original part of the untanking tower substation maintenance apparatus. Manufactured by the DeLaval Separator Company, the oil press heats the oil in order to remove water and contaminants from the OCBs and transformers. The apparatus is similar in operation to a dairy cream separator, in that centrifugal force is used to separate liquids and other contaminants from the oil. The press is powered by a 3-phase, 60 cycle 320 volts, 8.4 amperes motor. During the cleaning process, the oil passes through paper filters fitted between twenty metal discs (see HAER Photograph No. WA-69-A-7, left background).[12] Water and other contaminants are collected in a bucket following the cleaning process (see HAER Photograph No. WA-69-A-7, right foreground). Following treatment in the oil press, the oil is tested for purity before it is rerouted through the manifold system to various substation equipment.[13]

Although the complex and cumbersome untanking process dictated the distinctive form of architectural styling represented by the Bonneville Power Administration Chehalis Substation untanking tower, the structure did not serve the function for which it was designed until the 1970s. Early in the operation of the Chehalis, and of other BPA substations, personnel discovered that placing a tent or temporary frame structure over the transformers on-site was more efficient than moving the equipment into untanking towers for repair. The only transformers untanked at the Chehalis untanking tower were transported to that facility from Longview, Washington, in the 1970s.[14]

At present, the assembling (untanking tower) is used by BPA line crews for the maintenance of line vehicles and equipment. Because of the high cost of heating the 63-foot-high room, the BPA proposes to install a 16 x 20-foot roll-up utility door in the smaller portion of the northwest wing untanking room, presently known as the electrician's workshop. With a ceiling height of ca. 20 feet, the present electrician's workshop will provide a more cost-effective work space for maintenance activities than the much larger assembling room (see HAER Photographs No. WA-69-A-3 and WA-69-A-5 for exterior and interior views, respectively, of the electrician's workshop).

As the first monumental federally-generated electrical power distribution and transmission system established in the western United States, the newly-created BPA had no prior model on which to design its substations, of which untanking towers and other substation structures and buildings were a part. Early BPA engineering reports discussed the evolution of the distinctive design of the sophisticated Master Grid system, and indicated reasons for the adoption of the particular style of architecture that characterizes most BPA substation control houses and untanking towers:

> The task was made difficult at the start by the lack of any previous construction on the [Bonneville] Project to use as a guide. It was necessary to build up a reference file consisting of catalogues, drawings, specifications, and technical information from various other substations and construction jobs in all parts of the country. It was necessary to set up certain design standards as the work progressed. The basic idea, which has been followed wherever possible, is to make a unit design which can be either extended or retracted to fit the requirements of any one of a number of various sized stations.[15]

Clearly, early BPA officials understood the importance of standardization of design in facilitating rapid construction of the Master Grid. However, anticipation regarding America's entry into World War II undoubtedly influenced adoption of a design for substations and their attendant structures, buildings, and objects that allowed for immediate expansion of facilities that American involvement in a world war was likely to entail. Because of these and other pragmatic and security concerns, adoption of a standard design resulted in the uniformity of appearance typical of most substation structures dating from the construction years of the Master Grid (1939-1945).

HISTORICAL CONTEXT

Public Power and the Creation of the Bonneville Power Administration

The creation of the present Bonneville Power Administration (BPA) represented the culmination of years of debate by private and government supporters for the concept that "water power belonged to the people and should by publicly developed."[16] In large, this philosophy developed in response to growing fears by the American public and by government that a few powerful electric utility holding companies could, in essence, extort American consumers and industry through their monopolistic control of hydroelectric utilities and water power sites.[17] And nowhere was the potential for hydroelectrical development greater (or more vulnerable to monopolistic domination) than it was in the northwestern portion of the United States. By the mid-1930s, the hydroelectric potential of the region was well established and widely publicized. For example, a report published by the Federal Power Commission during the decade of the 1930s estimated that the states of Washington, Oregon, and Idaho alone possessed over 40 percent of the entire undeveloped hydroelectric energy in the nation.[18]

Upon Franklin Delano Roosevelt's election to the presidency of the United States in 1932, and during his nearly twelve years in office, Roosevelt worked to make low-cost, federally-developed hydroelectric power a reality. He enacted the Tennessee Valley Authority Act of 1933, the Securities and Exchange

Act of 1934, the Public Utility Act of 1935, the Rural Electrification Act of 1936, and the Bonneville Project Act of 1937. These five major laws set into motion the theme of public power:

> These five laws outlined a major change in national policy. They constituted a mid-course correction, indeed a turning point, in the Nation's handling of the electric power opportunity. After 50 years of laissez faire, or hands off attitude, the Congress declared the furnishing of electric service to be a public utility responsibility affected with a public interest. The Federal Government made a basic shift from a passive role to an active approach.[19]

Under the National Industrial Recovery Act of 1933, Congress authorized funds for construction of Bonneville and Grand Coulee dams on the Columbia River, to be constructed by two separate Federal agencies, the U.S. Army Corps of Engineers and the Bureau of Reclamation (BOR), respectively. However, the question of
which existing agency, or what new department, would transmit and market the power generated from those hydroelectric developments had not been established. This issue was settled on August 20, 1937, when President Roosevelt signed the Bonneville Project Act, which created a new bureau, the Bonneville Project. In 1940, the bureau's name was changed to its present appellation, the Bonneville Power Administration (BPA).[20] The previously-enacted Bonneville Power Act "granted to the BPA authority to construct and operate an electrical transmission system, and to establish a rate system by which customers would be charged for Federal power.[21]

As America moved toward entry into World War II (1941-1945), global events hastened design and construction of the Master Grid envisioned by early BPA administrators. National security, defense-production requirements, and the potential demands those needs could place on the installed capacity of Bonneville Dam (completed 1938) comprised a 15-page section, entitled "Growth of Consumption and of Installed Capacity," of the BPA's first annual report. Published in December 1938, the report was written by the BPA's first administrator and brilliant director, James Delmage "J. D." Ross. In that document, the superintendent-on-leave from Seattle City Light and consultant to President Roosevelt, Ross presented his concept of what shortly became the BPA Master Grid electrical power marketing and transmission network. As fully developed, the plan devised by Ross and other BPA planners involved the "intertie" of both Bonneville Dam and Grand Coulee Dam (completed 1941):

> When completed, the blueprint Ross and his associates designed was termed 'an advanced synchronized-at-the-load master system.' A skeletal network of 230,000 volt transmission lines linked the major population centers and generation plants [in Washington and Oregon] in what was referred to as the 'loop.' Radiating outward from the 230 kv loop would be transmission lines of lesser voltages serving individual customers, such as cities and small towns, industrial plants, and utility districts . . . . Although the system, as designed in the spring of 1938, comprised but a fraction of the facilities it was to contain within a few short years, the original 'Master Grid' is still in place, serving as the spine of a greatly-expanded network.[22]

Construction and Role of the Chehalis Substation

More than fifty electrical substations, of which the Chehalis Substation is one, were constructed at vital locations along the BPA loop, and constituted part of the BPA's original Master Grid. Substations served a variety of functions, including routing and control of electrical power flows, transforming voltage to higher or lower levels, and functioning as delivery points for individual customers, such as private or publicly-owned utilities, or industries. Major structures that typically comprised Master Grid substations included control houses and untanking towers. Of these, the one-story control houses served the most important function, as it was from those structures that operators supervised the routing and control of electric power and operated associated electrical equipment in the substations switching yard. With their imposing height, untanking towers presented a more dramatic appearance than did the more prosaic control houses, although the former fulfilled the less important function of repair and servicing of substation equipment and were not directly involved with the transmission of electrical power. Nearly all of the control houses and untanking towers (with the exception of those at the Troutdale, Oregon, and Tacoma, Washington, substations) were of formed
concrete construction, and are similar in design and appearance.[23] As conceived by BPA architects working under the direction of Dean R. Wright, these distinctive structures admirably integrate art and function:

> Lacking ornamentation in their simple architectural composition, the BPA buildings bear virtually no reference to stylistic conventions of the past. On the buildings' exteriors, piers rise uninterrupted to the cornice coping, dominating horizontal string courses, giving the appearance of a vertically streamlined, unified mass. Modernistic influence is expressed in clean lines and abstract geometric elements, reflecting the theme of "high tech," popular at the time and highly appropriate for the BPA facilities. Porthole windows in some buildings mirror similar windows in ships, planes, and trains, projecting an image of speed and transportation, recurring themes in the Art Moderne style. The use of unadorned concrete surfaces, shallow metal overhangs over wide entryways, metal sash, multi-paned windows, and flat roofs was very prevalent on public buildings of the day, giving rise to a number of appellations for the style, including Depression Era Federal Government, Stripped [Starved] Classical, Art Moderne, Half Modern, and Transitional.[24]

The Chehalis Substation, which occupies one of the crossroads of the BPA's original Master Grid, was one of the earliest constructed. Workers began clearing the site in December of 1939. When completed in 1941, the substation served as "an important link in the 230 kv transmission line connecting Puget sound with the Vancouver-Portland metropolitan area and the hub of the BPA system at Ross Substation" in Vancouver, Washington.[25] Situated on a major north-south axis within the BPA power network, the Chehalis Substation also featured smaller "feeder" lines. Those lines served the nearby sites of Chehalis and Centralia and connected the Chehalis Substation with the Raymond Substation in Pacific County. The Raymond Substation "served locally-owned utilities in Grays Harbor, Wahkiakum, and Pacific counties, and the cities of Raymond, South Bend, and Cosmopolis near Aberdeen [Washington].[26]

As construction proceeded, local newspapers reported on the progress of the Chehalis Substation. Those articles provide both a chronology of activities as they affected substation development, as well as reveal larger regional and national events that influenced the formation of the BPA Master Grid network.

As reported by the Centralia Tribune of June 28, 1940, men employed as part of President Roosevelt's Great Depression economic recovery program, the Works Progress Administration (WPA), played a major role in construction of the Chehalis Substation and in the "stringing" of electrical transmission lines in Lewis County:

> With clearing work rapidly being completed, the task of stringing wires for the Bonneville transmission lines in Lewis County is just beginning, it was learned Wednesday from Fred Garrison, supervisor of the project in this area.
>
> Majority of work being done by four WPA crews totaling 465 men, is in clearing 175-foot right-of-ways in preparation for the stringing of one set of wires. In most places, the crews will return later to widen the right-of-ways to 300 feet, Garrison declared.
>
> Excepting portions of the main line between Napavine and Seattle, WPA crews have completed all right-of-way clearing in the county.[27]

The preceding week, the Chehalis Daily Chronicle announced the bid opening and award contract for construction of the control house and "service building" (untanking tower) at the substation. That article also listed other contractors bidding for the contract and described the appearance and function of the untanking tower:

> The Bonneville Power Administration announced today O. R. Weyman, Portland, as low bidder on construction of a concrete control house and service building at its substation near Chehalis. His Bid was $100,808.
>
> Other bids: S. S. Mullen, Inc., Seattle, $101,013; West Coast Construction Company, Seattle, $104,007; Western Construction Company, Inc., Seattle, $109,370; Malarkey and Kallander, Portland, $118,200 . . . .
>
> The service building [present untanking tower], four stories high, will occupy a ground space of 114 by 84 feet. It will consist of a large assembly room, running the full height of the structure and with a traveling crane mounted in the ceiling; a store room, oil room, office, shop and locker room. It will be used for the repair and maintenance of heavy electrical equipment, such as the 100-ton transformers to be installed at the substation.[28]

Within months of the bid opening, the Chehalis Chronicle (the word Daily had recently been dropped) described the awesome spectacle of the transportation and arrival of the giant transformers to the nearby village of Napavine (located ca. 2.0 miles southeast of the Chehalis Substation), and from there to the substation:

> When the Bonneville Power Administration Substation on Newaukum bill [local name of substation site] is complete, there will be four buge transformers, which weigh around 150 tons eacb, in operation.
>
> The first of these immerse [sic] transformers was transported Friday from Napavine to the substation. They originally are shipped from the Westingbouse Electric Company in Pittsburg [sic] to Napavine, where they are lodged until taken to the substation.
>
> To transport one of the transformers from Napavine to the station on Newaukum Hill is in itself quite a feat. At Napavine the transformers are stripped of all the smaller parts which are taken away first. When the machine has been torn to pieces, the hulk which remains weighs around 80 tons.
>
> Special trailer cars are maintained by the Bonneville company to carry these 80 tons of macbinery to the destination. The trailers have 32 wheels and before the transformers may be taken along a road permission must first be obtained from the bighway department.[29]

The untanking tower, designed to service and maintain the Chehalis Substation's four huge transformers, was completed in March 1941, just months before America's entry into World War II, following the Japanese attack of December 7, 1941, on American naval installations at Pearl Harbor, Hawaii. Because of the Chehalis Substation's proximity to the Washington Coast (located a distance of less than 100 miles to the west), the vital role the substation played in national security made the facility vulnerable to possible enemy attack. Various entries noted in the original Chehalis Substation "Log Books" reflect those grave concerns. The log books represent the daily record of substation activities kept by control house operators. They are presently maintained in the control house at the substation. Those records indicate BPA's concern for possible sabotage of transmission lines and substation structures and equipment, as well as apprehension over possible air attack by Japanese aircraft. The following excerpts from the log books highlight these concerns, beginning in April 1941, before the Japanese attack on Pear Harbor:

> Thursday, April 10, 1941, 8:00 a.m.: "Leave door to ballway of control house unlocked. Might bave to get in the control house in a hurry. Keep all of the other doors locked. All picture taking of substation is taboo. In case guard leaves, he is to tell the operator, operator will then do what he can towards keeping people wbo has no business here <u>out</u>."[30]
>
> December 7, 1941, 5:58 p.m.: "Mr. Duffy called and informed us not to let anybody into station that has not a regular Bonneville pass. And no private cars allowed inside fence. There also will be an order on yard lighting issued.[31]
>
> Monday, December 8, 1941, 4:00 p.m.: "All lights out in yard and station at 11:00 p.m. for blackout. Ordered by B.P.A. Guard will turn lights off in untanking tower and warehouse."[32]

Thursday, December 25, 1941, 9:48 p.m.: Sgt. Geer of the State Patrol informed me he had received the information from Col. Morrow of the Army that saboteurs were going to attempt the disruption of communication service, and advised us to be on the alert.[33]

Saturday, December 27, 1941, 4:40 p.m.: "Officer Vogel of the State Patrol reports that Col. Morrow is removing his guards at this time (no further information on the matter)."[34]

Wednesday, December 31, 1941, 11:00 a.m.: "Rifle was taken off desk and placed in cloak closet by water fountain."[35]

SUMMARY

The present serene ambiance of the Chehalis Substation and its manicured grounds reveals no hint of the anxiety associated with security of that facility preceding, during, and immediately following World War II. Yet, the evolution of social and political values that led to the development of the BPA Master Grid network, the role the development of that hydroelectric transmission and marketing network played in the socio-economic development of the Pacific Northwest region of the United States, and the critical function the BPA exercised during World War II indicates the eminent position that system has held in shaping local, regional, and national affairs to this day.

In the decades since the anxious years encompassing World War II, the original BPA Master Grid system has been expanded to include a 14,700 circuit-mile grid of high-voltage transmission lines connecting utilities through the BPA's service territory in eight western states.[36] Today, the Bonneville Power Administration Chehalis Substation untanking tower is representative of the engineering skills, architectural design, and human ingenuity that coalesced in the conception and completion of one of the greatest Federal undertakings of the twentieth century, the creation of the BPA Master Grid electrical transmission network.

1. Gene Tollefson, BPA and the Struggle for Power at Cost (Portland, Oregon: Bonneville Power Administration, 1987), 146.

2. Craig Holstine and Gloria Lenz, "Bonneville Power Administration Master Grid, Discontiguous Historic District," Nomination to the National Register of Historic Places, on file in the Washington State Office of Archaeology and Historic Preservation, Olympia, Washington, 1987, Sec. 8:1.

3. Ibid., Sec. 7:2.

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5. Tom Wallace, interview with author, Chehalis Substation, Lewis County, Washington, July 22, 1992.

6. Buck Ballou, interview with author, Chehalis Substation, Lewis County, Washington, July 22, 1992.

7. Ibid.

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10. Tom Wallace, July 22, 1992.

11. Gene Moore, interview with author, Chehalis Substation, Lewis County, Washington, July 22, 1992.

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14. Leo Closner, telephone conversation with author, July 20, 1992.

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17. Ibid., 26.

18. Craig Holstine, "Power to the People: Construction of the Bonneville Power Administration's 'Master Grid,' 1939-1945," The Pacific Northwest Forum, vol. 1, no. 2, Spring 1988, 35-36.

19. Norwood, 1978, 27.

20. Holstine, "Power to the People," 1988, 36-37.

21. Ibid., 37.

22. Ibid., 37-38.

23. Holstine and Lenz, 1987, Sec. 7:4.

24. Ibid., Sec. 7:5.

25. Ibid., Sec. 7:12.

26. Holstine, "Power to the People," 1988, 41.

27. Centralia Tribune, June 28, 1940.

28. Daily Chronicle (Chehalis, Washington), June 21, 1940.

29. Phyllis Hall, "Giant Transformers Being Unloaded at Substation," Chronicle, June 21, 1941.7.

30. Log Book, No. 2 January 29, 1941 through August 17, 1941, maintained in the control house of the BPA Chehalis Substation, n.p.

31. BPA, Log Book No. 2, August 18, 1941 through May 7, 1942, maintained in the control house of the Chehalis Substation, n.p.

32. Ibid., n.p.

33. Ibid., n.p.

34. Ibid., n.p.

35. Ibid., n.p.

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